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DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Means for Facilitating the Starting of Compressors

We, FICHTEL & SACHS A.G., a German Body Corporate, of Schweinfurt am Main, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to starting aid devices for compressors. It is known that compressors start up with difficulty. As a remedial measure load relief devices are employed which cause the compressor to start without load, so that the compressor operating motor is required initially to overcome only the inertia of the normally idle parts. In connection with such devices, either the intake valve is continually held open during starting, or there is provided between the intake side of the compressor and the swept portion of the cylinder, a valve which is open upon starting and is closed only after a substantial speed of operation has been attained. In the case of larger compressors, such starting means are installed outside the compressor as special apparatus.

In the case of smaller compressors, starting devices are, so far as possible, installed in the compressor or placed directly on the compressor. There are starting devices in connection with which the oil pressure necessary for compressor lubrication and developed as the compressor gains speed is utilized as an actuating means for establishing normal load conditions. The starting device of the present invention is of this class.

In accordance with the present invention a starting device is provided which comprises normally effective load relief means, and means utilizing the oil pressure of the compressor lubricating system, which is gradually developed as the compressor gains speed, for rendering the load relief means ineffective. It is a feature of the invention that all machine parts of the starting device are installed in a simple and suitable manner in other compressor parts which are already present.

[*Price 3s. 6d.*]

The subject matter of the invention will be described by way of example with reference to the accompanying drawing containing Figures 1 and 2.

In the drawing forming part of this specification;

Figure 1 is a fragmentary view in sectional elevation of a practical and advantageous illustrative form of starting device embodying the invention; and

Figure 2 is a view similar to Figure 1 of a further illustrative embodiment.

A compressor drive shaft 1 runs in a bearing 2 which has an oil trough 3 and an oil supply 4. The oil supply 4 is supplemented in any desired manner. A crank pin 5, carried by the shaft 1, drives a connecting rod 6 for reciprocating a piston 7 which piston works in a cylinder 8. A valve plate 9, which extends across one end of the cylinder, has a suction or intake valve 10 and a delivery valve 11, and is closed off by a cylinder head 12.

In the valve plate 9, there is a cylinder bore 13 with channels 14, 15 and 16, which connect the suction vapor space 17 of the cylinder head 12 with the piston displacement space 18 of the cylinder 8. In the cylinder bore 13 there is provided a movable oil pressure piston 19 having a reduced abutment portion 20 at one end and a needle valve 21 at the other end. The cylinder bore 13 is closed by an abutment plug 22. A compression coil spring 23 acts on the oil pressure piston 19, urging it constantly toward the left.

The shaft 1 has two recesses 24 and 25, which are connected by an oil conveying thread 26. From the oil trough 3 an extension 27 extends into recess 24 so that the oil supply 4 can flow into recess 24. This oil is forced by the oil conveying thread 26, under a pressure which varies with the velocity of the shaft 1, through the channel 28, and thence into the cylinder bore 13.

The manner of operation is as follows:

The oil which is pressed by the oil conveying thread 26 against the left end of the oil pres-

sure piston 19, moves the latter against the force of the spring 23 until the valve needle 21 reaches the portion of the channel 15 which is developed as a valve seat, and closes the passage. In this way communication via the connection 14, 13, 15, 16 between the vapor chamber 17 and the piston displacement space 18, which by-passes the valve 10, is cut off. The compressor, prior to this interruption, has moved the compressible fluid idly back and forth through the channels 14, 15 and 16, and the compressor has therefore run without load. After the interruption of channels 14, 15 and 16, however, the compressible fluid is drawn into the cylinder 8 exclusively through the suction valve 10 and is forced out exclusively through the delivery valve 11, so that the compressor is caused to be fully effective as a compressor.

The interruption of channels 14, 15 and 16 continues as long as sufficient oil pressure is present to maintain the valve 21 closed. If the compressor is stopped, the oil pressure drops to zero, and the spring 23 forces the oil pressure piston 19 back until its reduced projection 20 hits against the plug 22. The needle valve 21 is thereby lifted from its seat and the channels 14, 15 and 16 are caused to constitute an open connection so that the compressor can start up without load and run without load until oil pressure has again built up sufficiently to close the needle valve 21.

The tight sealing of the needle valve 21 on the valve seat of channel 15 depends upon the precise manufacture of the corresponding parts. This very precise manufacture is difficult and expensive. Leakage leads to losses in delivery capacity. An improvement is obtained in accordance with Figure 2 in that the oil pressure piston 19*a* is caused, through a stem 29, to press a ball 30 into the tapered valve seat 31. This causes the corresponding channel 16*a* to be closed when oil pressure is present. Upon elimination of the oil pressure, the spring 23*a* forces the oil pressure piston 19*a* back, the valve ball is freed, and it is separated sufficiently far from its valve seat for the channels 14*a* and 16*a* to be open. In all other respects the structure of Figure 2 is desirably the same as that of Figure 1. Corresponding reference numerals have therefore been applied to corresponding parts with the subscript *a* added in each instance, and no further detailed description will be given.

WHAT WE CLAIM IS:—

1. In a compressor having a compression chamber, a compressing member operable therein, a drive shaft for the compressing member, oil pressure generating means responsive to the drive shaft, means forming a supply chamber from which compressible fluid is drawn into the compression chamber, and an intake valve interposed between the supply chamber and the compression chamber, the improved starting device which includes a load relief channel means forming an alternate means of communication between the supply chamber and the compression chamber bypassing the intake valve, a relief channel controlling valve, and a piston exposed to the oil pressure developed by the oil pressure generating means and responsive thereto for progressively moving the valve toward channel closing position as the drive shaft gains speed, and a spring constantly urging the piston away from valve closing position but yieldable to permit closing of the valve by the piston in response to a predetermined oil pressure.

2. In a compressor as set forth in claim 1, an improved starting device as set forth in which the relief channel controlling valve is in the form of a needle valve unitary with the oil pressure operating piston.

3. In a compressor as set forth in claim 1, an improved starting device as set forth in which the relief channel means provides a tapering seat and the relief channel control valve is a ball valve distinct from the piston but engageable thereby and adapted to be guided to closed position by the tapering seat.

4. Means for facilitating the starting of a compressor substantially as described herein and as illustrated by Figure 1 or Figure 2 of the accompanying drawings.

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